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FLEA BEETLES (COLEOPTERA: CHRYSOMELIDAE) OF ISPARTA, TURKEY, WITH HABITAT USE AND HOST PLANT ASSOCIATIONS

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Abstract.—85 species and 2 subspecies belonging to 14 genera of the Alticinae collected from Isparta, Turkey, and adjacent areas in 2002–2003 are ecofaunistically investigated. The species are categorized as abundant, common, or rare based on the relative abundance for each species. An ecological discussion of findings, including habitat use and host plant preference for each genus, is provided with related tables.

Key Words: Alticinae, Isparta, fauna, ecology, food plant, habitat use, abundance

The Alticinae are highly specialized phytophagous insects well adapted to their host plants. Both the adult and larval forms feed on stems, roots, and leaves of plants from various plant families (Jolivet 1988, Konstantinov and Vandenberg 1996). Most Alticinae species are neither very host specific nor general feeders. For each genus, the majority of species feed on hosts in one or a few plant families that are often chemically related (Furth 1979).

Flea beetles occur virtually everywhere, in almost all types of habitats. Palearctic flea beetle communities usually occur in open areas near forests or scrublands often associated with rivers or lakes, and nearly all kinds of meadows (Konstantinov and Vandenberg 1996).

Turkey is a biologically diverse region mainly due to being a bridge between Asia and Europe, and also a link to the Ethiopian region via the Arabian peninsula, thus providing a natural pathway for the spread of species both north–south and east–west (Çıplak 2003). Because of this important geographical situation and being a transitional region, many different macro and microhabitats occur in Turkey. The Alticinae in Turkey are relatively poorly studied, especially from the ecological point of view.

Isparta has an altitude of 1050 m, situated in the western Mediterranean part of Turkey. Both the Mediterranean and Central Anatolia have major extensions into Isparta. Northern parts of the area have arid climatic conditions while southern parts are temperate. These different climatic factors and geographical position have allowed a rich flora and fauna to occur in the research area. According to Gruev (2002), Isparta is one of the important regions with refugium habitats in Asiatic Turkey.

The purpose of this study is to determine the flea beetle species existing in the research area with some additional ecological data such as generally preferred food plant families and habitat types.

Materials and Methods

This study is based on material gathered throughout the spring season from Isparta and adjacent areas in 2002–2003. A total of 5939 beetles were collected by sweeping. The relative abundance of each species was determined by using the sample formula $n_x/N_T \times 100$ (n_x = individuals of species x;

N_T = total individuals of all species). All the species were categorized as abundant, common, or rare based on these abundance degrees. Species which constituted more than 2% of the total number of captured beetles were considered as abundant, 0.1–2.0% as common, and less than 0.1% as rare. The specimens are deposited at the Department of Biology, Faculty of Art and Science, Süleyman Demirel University.

Results and Discussion

As a result of collections in the study area, we identified 85 species and 2 subspecies of flea beetles belonging to 14 genera; 31 species in the genus *Longitarsus* Latreille, 16 in *Phyllotreta* Chevrolat, 8 in *Chaetocnema* Stephens, 7 in *Psylliodes* Latreille, 6 in *Dibolia* Latreille, 5 in *Aphthona* Chevrolat, 3 species of *Altica* Fabricius and *Neocrepidodera* Heikertinger, 2 species of *Crepidodera* Chevrolat and *Mantura* Stephens, and 1 species of *Ochrosis* Foudras, *Derocrepis* Weise, *Epitrix* Foudras and *Podagrica* Foudras (Table 1).

The most common and dominant genus in the research area was *Longitarsus* of which species occur in almost all types of habitats, including piedmonts, heath lands, meadows, and open spaces near forests or scrublands (Table 2). Xerophile *Verbascum spp.* (Scrophulariaceae), growing near roadsides, were especially preferred by many species of *Longitarsus*. Because of the broad range of habitats, *Longitarsus* has a wider range of species diversity and a large range of host plant families than most Alticinae genera (Furth 1980). In our studies Boraginaceae, Scrophulariaceae, and Lamiaceae were most commonly used by *Longitarsus* species (Table 2).

Phyllotreta is the second largest Alticinae genus in Isparta. Cultivated areas, such as fields, gardens, and orchards, and shrubs and roadsides are commonly preferred habitats. Among the genera found in the research area, *Phyllotreta* species mainly prefer plants belonging to the family Brassicaceae. The glucosinolates characteristically present in Brassicaceae are important feeding stimulants and play a significant role in the host plant selection of cruciferae-feeding leaf beetles (Matsuda 1988, Nielsen 1988). *Phyllotreta spp.* cause serious damage by producing small, tiny holes on the leaves of both cultivated and wild plants. Also it was observed that a single plant might be simultaneously shared by two or more *Phyllotreta* species. For example, *P. erysimi* Weise and *P. variipennis* (Boieldieu) were both found on *Diplotaxis tenuifolia* (L.) DC. and *Cardaria draba* L. Desv. (Brassicaceae). The most abundant *Phyllotreta* species was *P. corrugata* Reiche (3.8%), and it occurred nearly everywhere in Isparta Province.

Chaetocnema, another common genus in the research area, are the most abundant species collected from humid habitats. Members of this genus typically occur in various kinds of meadows, marshes, and moist areas often associated with streams or lakes. Poaceae species growing in these habitats were the most preferred food plants (Table 2). The predominant *Chaetocnema* species in Isparta were *C. tibialis* (Illiger) (4.1%) and *C. coyei* (Allard) (2.6%).

Psylliodes species account for 8% of the flea beetle species in Isparta. They were particularly common in steppe areas, in forests mainly represented by woodshrub vegetation, and in adjacent fields. Poaceae, Brassicaceae and Asteraceae were their most preferred food plant families. Some *Psylliodes* species feed on oaks after their normal host plant season had finished (Furth 1983, Booth et al. 1990). However, we could not confirm such feeding in the research area.

In Isparta, *Aphthona* species occur in piedmonts, steppe habitats between forests and fields, and in small valleys. In the research area, all *Aphthona* species were found on various *Euphorbia* (Euphorbiaceae). There is a distinct parallelism between the distribution of most *Aphthona spp.* and *Euphorbia* plants as stated by Konstantinov et al. (2001). *Aphthona pyg-*

Table 1. List and relative abundance of flea beetles collected from Isparta. Categories are "+" for rare species; "++" for common species; and "+++" for abundant species.

Taxa	Number (n_x)	Relative Abundance (%)	Abundance Category
***Phyllotreta* Chevrolat**			
P. aerea Allard	69	1.2	++
P. astrachanica Lopatin	39	0.7	++
P. atra (Fabricius)	24	0.4	++
P. bolognai Biondi	18	0.3	++
P. corrugata Reiche	225	3.8	+++
P. cruciferae (Goeze)	72	1.2	++
P. diademata (Foudras)	42	0.7	++
P. egridirensis Gruev & Kasap	19	0.3	++
P. erysimi Weise	175	2.9	+++
P. ganglbaueri Heikertinger	5	0.08	+
P. nemorum (Linnaeus)	9	0.2	++
P. nigripes (Fabricius)	51	0.9	++
P. pontoaegeica Gruev	30	0.5	++
P. procera (Redtenbacher)	45	0.8	++
P. variipennis (Boieldieu)	232	3.9	+++
P. vittula (Redtenbacher)	26	0.4	++
***Aphthona* Chevrolat**			
A. atrovirens (Förster)	3	0.05	+
A. bonvouloiri Allard	76	1.3	++
A. nigriceps (Redtenbacher)	13	0.2	++
A. nigriscutis Foudras	67	1.1	++
A. pygmaea Kutschera	294	5.0	+++
***Longitarsus* Latreille**			
L. aeneicollis (Faldermann)	22	0.4	++
L. albineus (Foudras)	25	0.4	++
L. alfieri furthi Gruev	30	0.5	++
L. anchusae (Paykull)	58	1.0	++
L. ballotae (Marsham)	70	1.2	++
L. bertii Leonardi	27	0.5	++
L. corynthius corynthius (Reiche et Saulcy)	50	0.8	++
L. dimidiatus (Allard)	42	0.7	++
L. exoletus (Linnaeus)	63	1.1	++
L. karlheinzi Warchalowski	77	1.3	++
L. kutschera Rye	3	0.05	+
L. linnaei (Duftschmidt)	73	1.2	++
L. longipennis Kutschera	163	2.7	+++
L. luridus (Scopoli)	227	3.8	+++
L. lycopi (Foudras)	139	2.3	+++
L. melanocephalus (De Geer)	43	0.7	++
L. minusculus (Foudras)	5	0.08	+
L. nasturtii (Fabricius)	1	0.02	+
L. nigrofasciatus (Goeze)	215	3.6	+++
L. ochroleucus (Marsham)	118	2.0	+++
L. onosmae Payerimhoff	16	0.3	++
L. parvulus (Paykull)	134	2.3	+++
L. pellucidus (Foudras)	65	1.1	++
L. picicollis Weise	36	0.6	++
L. pinguis Weise	2	0.03	+
L. pratensis (Panzer)	46	0.8	++
L. pulmanariae Weise	5	0.08	+
L. salviae Gruev	69	1.2	++
L. scutellaris (Rey)	15	0.3	++

Table 1. Continued.

Taxa	Number (n_x	Relative Abundance (%)	Abundance Category
***Longitarsus* Latreille**			
L. solaris Gruev	4	0.07	+
L. stragulatus (Foudras)	21	0.4	++
***Altica* Fabricius**			
A. deserticola (Weise)	152	2.6	+++
A. lythri Aubé	3	0.05	+
A. oleracea (Linnaeus)	226	3.8	+++
***Ochrosis* Foudras**			
O. ventralis (Illiger)	20	0.3	++
***Neocrepidodera* Heikertinger**			
N. crassicornis (Faldermann)	4	0.07	+
N. ferruginea (Scopoli)	62	1.0	++
N. transversa (Marsham)	5	0.08	+
***Crepidodera* Chevrolat**			
C. aurata Marsham	123	2.1	+++
C. lamina (Bedel)	28	0.5	++
***Derocrepis* Weise**			
D. anatolica Heikertinger	77	1.3	++
***Epitrix* Foudras**			
E. dieckmanni Mohr	86	1.4	++
***Podagrica* Foudras**			
P. malvae (Illiger)	135	2.3	+++
***Mantura* Stephens**			
M. matthewsi (Curtis)	2	0.03	+
M. rustica (Linnaeus)	2	0.03	+
***Chaetocnema* Stephens**			
C. concinna Marsham	45	0.8	++
C. conducta (Motschulsky)	64	1.1	++
C. coyei (Allard)	155	2.6	+++
C. hortensis (Geoffroy)	75	1.3	++
C. montenegrina Heikertinger	5	0.08	+
C. sahlbergi (Gyllenhal)	20	0.3	++
C. scheffleri (Kutschera)	14	0.2	++
C. tibialis (Illiger)	245	4.1	+++
***Dibolia* Latreille**			
D. numidica Doguet	3	0.05	+
D. occultans (Koch)	128	2.2	+++
D. rugulosa Redtenbacher	152	2.6	+++
D. schillingi Letzner	75	1.3	++
D. timida (Illiger)	5	0.08	+
D. tricolor Reitter	15	0.3	++
***Psylliodes* Latreille**			
P. cerenae Gök, Doguet and Çilbiroğlu	160	2.7	+++
P. chalcomerus (Illiger)	88	1.5	++
P. cupreus (Koch)	32	0.5	++
P. instabilis Foudras	141	2.4	+++
P. kiesenwetteri Kutschera	17	0.3	++
P. magnificus Gruev	2	0.03	+
P. sophiae Heikertinger	175	2.9	+++

Table 2. Habitat and preferred host plant families of the flea beetle genera occurring in Isparta (% calculated based on total number of species).

Genus	%	Habitat	Preferred Host Plant Families
Phyllotreta	19	Cultivated areas, road sides, orchards, shrublands	Brassicaceae, Resedaceae
Aphthona	6	Piedmonts, steppe areas, small valleys	Euphorbiaceae
Longitarsus	37	Heath lands, shrubs, arid piedmonts, meadows, open spaces, moist places along the banks of streams	Scrophulariaceae, Lamiaceae, Boraginaceae, Plantaginaceae Asteraceae, Convolvulaceae, Caryophyllaceae, Dipsacaceae
Altica	3	Moist areas associated with streams or lakes	Rosaceae, Scrophulariaceae, Asteraceae
Ochrosis	1	Bushes	?
Neocrepidodera	3	Moist areas including poplars	Violaceae, Lamiaceae
Crepidodera	2	Moist areas mainly consist of willows and poplars	Salicaceae
Derocrepis	1	Mixed shrub vegetations	Fabaceae
Epitrix	1	Field sides	Solanaceae
Podagrica	1	Irrigation ditches	Malvaceae
Mantura	2	Open spaces, steppe areas	?
Chaetocnema	9	All kinds of meadows, marshy places	Amaranthaceae, Poaceae, Cyperaceae
Dibolia	7	Semiarid and moist areas	Lamiaceae
Psylliodes	8	Mixed forests, scrublands, piedmonts	Poaceae, Brassicaceae, Asteraceae

maea Kutschera was the most abundant species (5.0%), and found in high population densities on different *Euphorbia*. *Aphthona nigriscutis* Foudras and *A. pygmaea* were sometimes seen feeding on the same host plant. *Aphthona nigriscutis* causes especially notable damage to the host plant leaves while feeding. Beetles nibble the upper sides of the leaves in large numbers. Leaves are nearly completely damaged.

The genus *Dibolia* is represented by 13 species throughout Turkey (Aslan et al. 1999), and 6 of them were found in Isparta. *Dibolia* species usually prefer wooded river banks, piedmonts that consist of shrubs, and open areas. We observed that members of this genus are closely associated with Lamiaceae (Table 2). Due to occurrence in large numbers, they skeletonize the leaves of various wild Lamiaceae, especially *Salvia spp.*

Three *Altica* species were determined from the research area. Among them, *Altica deserticola* (Weise) is particularly specialized on *Rubus canascens* DC. (Rosaceae) growing near streams. *Altica oleraceae* (L.) is not limited to a single host plant and was observed feeding on plant species from different families such as *Sangiosorba minor* Scop. (Rosaceae), *Veronica sp.* (Scrophulariaceae), and *Cirsium sp.* (Asteraceae). *Altica lythri* Aubé, is a rather rare species in the area.

Neocrepidodera species prefer herbaceous vegetation found in moist poplar forests. *Crepidodera* differs from other genera recorded in the investigation area by feeding behavior. These beetles are usually dendrophilic on Salicaceous plants growing in moist areas. Both species collected (*C. aurata* Marsham and *C. lamina* (Bedel)) were observed on the fresh leaves of *Salix spp.* and *Populus spp.* Adults nibble the leaves and cause damage due to their occurrence in high densities.

In Isparta, the genus *Epitrix* is represented by a single species, *E. dieckmanni* Mohr. Solanaceae is the most preferred food plant

family (Lopatin 1984, Furth 1997). Our samples were also found on *Lycium depressum* Stocks (Solanaceae) growing on rocks near a wheat field.

Mantura, Derocrepis, Podagrica, and *Ochrosis* have fewer species than other genera in Isparta Province. *Derocrepis anatolica* Heikertinger was found on *Genista tinctoria* L. (Fabaceae) growing in shrub vegetation including mainly oak and hawthorn, and *Podagrica malvae* (Illiger) on *Malva spp.* (Malvaceae). Food plants of *Mantura* and *Ochrosis* species were not determined.

Discussion

Analysis of the flea beetle fauna in Isparta shows that some species are closely associated with certain host plants. According to Jolivet (1992), the chemical composition and secondary substances produced by the plant are responsible for the trophic selection of insects. Lamiaceae and Brassicaceae are especially preferred food plant families by most of the flea beetle species in the study area. Many species of *Longitarsus* and *Dibolia* feed on Lamiaceae. This is probably because of the chemical structure, attractive smell, or possible taste of plants belonging to this family. *Phyllotreta* species show a distinct preference in food plant family, being mainly limited to Brassicaceae.

Our investigations revealed that flea beetle populations increase rapidly after over wintering as a response to the spring growth of the host plant. Species diversity was greatest in May–June.

The total number of Alticinae species recorded from Isparta is nearly ⅓ of the Turkish flea beetle fauna. This is because the investigated region has an important geographical position, suitable climatic factors, and different topographic zonation, all of which result in a rich flora and therefore a rich flea beetle fauna.

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